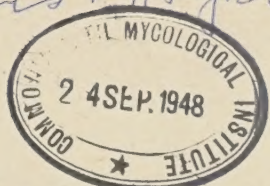


Lewis F H + Groves AB

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Cherry Leaf Spot Control in the Cumberland-Shenandoah Valley



THE PENNSYLVANIA STATE COLLEGE
SCHOOL OF AGRICULTURE

AGRICULTURAL EXPERIMENT STATION
STATE COLLEGE, PENNSYLVANIA

In Cooperation with the
Virginia Agricultural Experiment Station

PREFACE

This is the second general report of the cherry spray investigations conducted cooperatively by experiment station workers in Pennsylvania, Virginia and West Virginia. Authorship of this report is limited to the two investigators who conducted the major portion of the work over the past three years. C. F. Taylor of West Virginia and H. J. Miller of Pennsylvania withdrew from active participation in the project in 1943 and 1942, respectively. Relevant data of theirs are included and hereby gratefully acknowledged.

An effort has been made to summarize the results. Much detailed discussion has been omitted because of the relative unimportance of some points in the selection of a fungicide for use on sour cherries. Also, data from some experiments have been omitted because they contribute little to this discussion or merely confirm generally accepted theses. For example, a large volume of data concerning changes in fruit weight, solids content, pH and titratable acidity during the ripening process are of interest here only because they confirm the general practice of determining the effects of fungicides on fruit quality by counts taken at a median harvest date. Likewise, the effect of the soluble solids content of the fruit on the weight of fresh fruit necessary for a definite cut-out weight per can after processing has been studied in detail by the National Canners Association Research Laboratories, and our data on this point merely confirm what is already generally known.

Those interested in detailed procedure and data are referred to the *Appendix* and to the publications listed under *Literature Cited* at the end of this bulletin.

There was no seniority of administration of this project as there is no seniority of authorship of this report. Each participant was responsible for the conduct of the trials within his state.

This bulletin is also printed as Bulletin 415 of the Virginia Agricultural Experiment Station, with no change in text or authorship.

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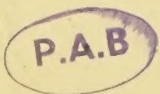


TABLE OF CONTENTS

	PAGE
Preface	2
Summary	4
Description of the Disease	5
Effects of the Disease on the Tree and Fruit	7
Control by Sanitation	10
Control by Fungicides	12
Commonly Used or Standard Materials	12
Lime-sulfur	12
Bordeaux mixture	13
The proprietary copper fungicides	13
The Newer Fungicides	14
Compound 341	14
The Isothans	17
The dithiocarbamates	18
Compound 604 or Phygon	19
Puratized	19
Compounds still strictly in the experimental stage	19
Compounds which have shown little or no promise on cherries.....	19
Discussion	20
Appendix (With Tables)	22
Literature Cited	40

SUMMARY

Leaf spot, caused by *Coccomyces hiemalis* Higgins, is the most important disease of sour cherries, and is the major factor responsible for the recent large number of tree deaths, severe tree injury, low yields and low quality fruit in the Cumberland-Shenandoah Valley.

The leaf spot control problem, as it existed when these studies were begun, applied to the entire region extending into several states. Workers in Pennsylvania, Virginia and West Virginia therefore planned and entered into a cooperative attack on the problem in an effort to clarify the situation. A general report covering the work from 1940 through 1942 was published in 1943 (3). This bulletin presents the data obtained from 1943 through 1947.

Brief descriptions are given of the disease, the life history of the causal fungus and the points of similarity between leaf spot and leaf injury caused by bordeaux mixture and yellows.

The effects of premature defoliation by leaf spot on the yield, health and vigor of the tree are discussed with some new data obtained following the severe leaf spot epiphytotic of 1945.

Summaries are given concerning the performance on cherries in the Cumberland-Shenandoah Valley of lime-sulfur, bordeaux mixture, the proprietary copper fungicides and all of the more important newer organic fungicides now being tested on fruit trees.

Stress is placed on the importance of giving adequate weight to the effect of fungicides on fruit quality in the development of a new spray schedule for sour cherries. The fungicide used influences fruit yields, size, color, solids content, pH, total acidity, weight of the seeds per pound of fruit, limb rub, cracking in wet weather, shriveling in dry weather and injury to the skin of the fruit by the fungicides themselves. Aside from obvious fruit injury, size is considered the most important fruit character affected by fungicides, but emphasis on absolute lack of dwarfing was tempered somewhat by the tendency of large fruits to be low in color, as well as in soluble solids, and acid, and to crack in wet weather.

The results indicate that two or three different fungicides are needed in the cherry spray program. Bordeaux mixture is considered fairly satisfactory for the sprays after harvest. Lime-sulfur, the proprietary copper fungicides and Compound 341 may be used in the sprays before harvest. Compound 341 has given excellent leaf spot control with no fruit dwarfing and little injury in most tests, but a suitable formulation must be prepared and standardized before its place in the cherry spray program can be determined.

CONTROL OF CHERRY LEAF SPOT *in the* CUMBERLAND-SHENANDOAH VALLEY

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DESCRIPTION OF THE DISEASE

Leaf spot, caused by the fungus *Coccomyces hiemalis* Higgins, is the most important disease of sour cherries in the Cumberland-Shenandoah Valley. It is the principal cause of premature leaf drop and, directly or indirectly, is the major factor responsible for most of our troubles with low yields and tree losses. Spray practices commonly employed on sour cherries were developed primarily for control of leaf spot. Other diseases and the insects which require consideration in the formulation of spray schedules, but which are not generally serious in sprayed orchards, include several fruit rots (caused by *Sclerotinia fructicola* (Wint.) Rehm, *Alternaria* sp., *Rhizopus* sp., etc.), powdery mildew (caused by *Podosphaera oxycanthae* (DC) De Bary), plum curculio (*Conotrachelus nenuphar* Herbst), cherry maggots (*Rhagoletis cingulata* Loew and *R. fausta* Osten Sacken) and black cherry aphid (*Myzus cerasi* Fabricius).

Leaf spot usually appears within one to three weeks after petal-fall as small red to purple spots on the upper surface of the leaf accompanied by pink to whitish-pink spore masses on the lower surface. The spots occur most frequently at the tip or near the margins of the leaf (fig. 1), but they may occur over the entire surface. The individual spots never become large, but they may be so numerous that they coalesce and thus kill large areas of the leaf. The appearance of numerous spots on the leaf is usually followed by rapid yellowing and dropping. The spots may separate from the healthy tissue and drop out, resulting in a "shot-hole" condition.

Following the first primary or ascospore-induced infections, the disease is spread by means of additional ascospores from the old leaves on the ground plus the much-more-numerous conidia from the new spots on the leaves. With long rain periods spaced at intervals through the summer and fall, heavy infection is followed by yellowing and dropping of the leaves in waves. Even with few spots present on the leaves, three or four infection periods spaced at intervals of one to two weeks may result in severe defoliation. New infections

may occur throughout the summer and fall, and are usually very numerous during the rains of September and early October when little fungicidal protection is provided.



Fig. 1.—Cherry leaf spot infections on Montmorency leaves.

The fungus overwinters in the old leaves on the ground, with the leaves which fall in September and October apparently much more important in the survival of the fungus than those which fall in midsummer. The fungus continues to grow in the dead leaves on the ground and produces ascospores in the spring. The ascospores are usually mature by the pink or early-bloom stage of growth of the cherry tree, and are discharged in wet weather from shallow apothecia on the lower surface of the dead leaves. These spores are carried upward by wind. If they lodge on a susceptible leaf under favorable temperature and moisture conditions, the spores germinate and leaf spot results in one to two weeks. Conidia may be produced in the same fruit bodies as the ascospores, but their importance in the survival of the fungus is uncertain. The primary infections initiated by ascospores are few in number compared to the secondary or conidially spread phase of the disease, but they serve

to re-establish the fungus in the tree and, if uncontrolled, assure a severe leaf spot problem in wet seasons.

The ascospores of the leaf spot fungus evidently need a higher temperature to germinate and enter the leaves than the apple scab fungus (*Venturia inaequalis* (Cke.) Wint.). The fungus enters the leaves through the stomates in the lower leaf surface. Generally the leaves are beginning to unfold and have open stomates by petal fall; so there is danger of leaf spot infections after that time. Once the fungus is established in the leaf, it is able to sporulate and initiate new infections at any range of orchard temperatures normally encountered in this region.

Various symptoms of this fungous leaf spot may be confused with other troubles on cherry, particularly the leaf injury caused by bordeaux mixture and other copper fungicides and the yellowing and dropping of leaves caused by a virus disease known as yellows.

One of the common forms of injury by bordeaux mixture occurs as leaf spots almost identical with those caused by the leaf-spot fungus. However, the fungous leaf spot can be identified readily by the presence of spore masses on the lower surface of the spots.

Another common type of injury caused by bordeaux mixture is the yellowing and dropping of leaves. This injury may be serious under both abnormally wet or dry conditions. Both leaf spotting and yellowing are often prominent following the use of bordeaux mixture on trees infested with aphids.

With yellows, most of the affected leaves show conspicuous yellow and green mottling and may drop in large numbers from some trees, while others are not affected. The symptoms usually appear about June 1 in this area, and are accompanied by a light to heavy wave of leaf drop depending on seasonal conditions. A few affected leaves and minor waves of defoliation may be observed at a later date during some seasons.

EFFECTS OF THE DISEASE ON THE TREE AND FRUIT

Failure to control leaf spot, with consequent defoliation of the trees before harvest, usually results in a crop of low quality fruit. This fact is rather generally recognized. The effects of failure to control leaf spot in one year on the yield, health and vigor of the trees the following year are, however, still a cause of controversy in this area. Some of the evidence on this point may be useful.

Studies in Michigan after the early defoliation of unsprayed trees in 1922 showed that the trees which had been prematurely defoliated produced fewer blossoms, the flowers were poorly developed and slower in opening, fewer cherries ripened and the cherries were smaller (1). Many fruit spurs died on the trees where leaf spot was not controlled, and the crop was greatly reduced on the spurs which survived. The defoliation reduced shoot growth and spur

development, thus reducing yield for several years. It was concluded from other Michigan studies (2) that premature defoliation was much more important in decreasing fruit bud formation than inadequate fertilization, and for that reason was of first importance in reducing yield.

Observations made in the Virginia plots during the late summer of 1945 revealed conspicuous differences in the size of buds on the unsprayed check trees and those which had retained their foliage. The average weight of buds from the Compound 341 sprayed plot was 147 mg.; whereas buds from the unsprayed trees averaged only 90 mg. (fig. 2). These latter buds did not have sufficient vitality to survive the winter.

Following the worst outbreak of cherry leaf spot on record, observations in northern Virginia in the spring of 1946 revealed a number of instances where previously healthy sour cherry trees had died for no apparent reason other than exhaustion following defoliation by leaf spot in May and June of 1945. This diagnosis was confirmed by the block of young trees used for experimental spraying. The unsprayed trees were distributed as entire rows at intervals through the block. When observed at full bloom in 1946, the unsprayed rows were devoid of bloom or active leaf buds (fig. 3). All of the unsprayed trees eventually died. None of the sprayed trees died, although Dithane on plot 12 (table 6) delayed defoliation only about four weeks. Six-year-old and previously well-cared-for trees in two orchards near Winchester were all killed. In both instances, the trees were unsprayed after the crop was destroyed by frost in the spring of 1945 (4).

In southern Pennsylvania early defoliation in 1945 was followed by the death of more than 25,000 trees, or more than 10 percent of the total cherry acreage, in addition to general killing of shoots, spurs and branches, and a light crop of low quality fruit in 1946. In no case observed did an orchard defoliated in June of 1945 escape without severe injury or death during the following winter. Where defoliation was delayed but virtually complete in July severe injury occurred but most of the trees survived. In the two known instances where leaf spot was controlled until late September the trees were not injured and bore a heavy crop of high quality fruit in 1946.

In the block of young trees used for experimental spraying in Pennsylvania in 1945 (tables 7 and 8), about one-third of the leaves remained on unsprayed trees on June 28. No trees died during the following winter. Shoot and spur killing was general on the unsprayed trees, and the bloom in 1946 was very light in comparison with adjacent sprayed trees. The 1946 crop of cherries on the trees unsprayed in 1945 remained of poor color until just before harvest, then darkened rapidly and unevenly, shriveled and dried during an abnormally short harvest season. The yield in 1946 averaged 36.2 pounds per tree with 56 percent No. 1 cherries on the trees unsprayed in 1945, and 107.0 pounds per tree with 79 percent No. 1 cherries on the trees where leaf spot was controlled best in 1945 (table 8).



Fig. 2.—(Above) The upper four clusters of buds were taken in September, 1945 from trees on which leaf spot had been controlled with Compound 341. The buds are plump and heavy. The lower four clusters were taken at the same time from the defoliated check trees. The buds are light and chaffy. The trees from which these buds were taken were all dead the following spring (fig. 3).

(Below) Terminal shoots from trees on which leaf spot was controlled and from defoliated trees. The two shoots at the left were from a tree sprayed with Compound 341; the two at the right were from an unsprayed check. The terminal growth of the unsprayed trees was conspicuously shorter and thinner. The shoot at the extreme right shows a typical terminal extension produced as a result of being forced into growth late in the season following early defoliation.

Further evidence of the relation of defoliation by leaf spot to death or severe injury to the trees was afforded by a cumulative spray experiment by Taylor in West Virginia (11). The experiment was started in 1939 on two-year-old trees. In 1945 heavy defoliation on the lime sulfur sprayed plots had stimulated second growth on 64 percent of the terminals by July 21. These secondary leaves were soon lost due to leaf spot and some tertiary growth developed. Following this poor control of leaf spot an estimated 72 percent of the branches were killed on the lime-sulfur sprayed plots. Four applications of either bordeaux mixture or Copper Hydro gave sufficient protection to avoid second growth and no winter injury followed.



Fig. 3.—(Right) Appearance of the 1945 unsprayed check trees on April 19, 1946. All of the trees are dead or dying. (Left) Appearance on same date of trees on which leaf spot was controlled in 1945. The trees are vigorous and in full bloom.

CONTROL BY SANITATION

It would appear from a consideration of the life history of the leaf spot fungus that the disease could be controlled by destroying the old leaves in which the fungus overwinters. Instances have been recorded by Keitt and his co-workers (6) and observed by the writers where leaf spot was controlled satisfactorily in relatively isolated plantings by routine raking and burning of the old leaves. In commercial plantings, however, destruction of the old leaves cannot be depended on as a single control measure. Many of the old leaves are not destroyed around the base of the tree and under neighboring trees. The greatest value of sanitary measures lies in reducing the fungous population and the strain upon the spray program.

Keitt and his co-workers (6) described an experiment in a large commercial

orchard in Wisconsin in which most of the orchard was cultivated several times starting before the blooming period. Several trees on one edge of the orchard were not cultivated. The uncultivated trees and one tree near the center of the orchard were not sprayed. Only occasional leaf spot lesions were present in early July on the cultivated tree, while heavy infection and defoliation had occurred on the uncultivated trees.

Many instances have been noted here where early spring cultivation seemed to be the determining factor in obtaining satisfactory leaf spot control with the usual spray programs. These observations were confirmed by data from two farms where conditions were alike on each farm except for the time of cultivation in the spring of 1947.

In one orchard with a very low population of the leaf spot fungus, cultivation of one-half the orchard during the blooming period reduced the amount of leaf spot present on June 18 to about one-half the amount present in the area not cultivated until three weeks after petal-fall.

On another farm a heavy cover crop of rye and vetch in one orchard was partially disked down by "trashy" cultivation of about 80 percent of the soil surface while the trees were in bloom. An orchard nearby was not disked until four weeks after petal-fall. The orchard cultivated during bloom had 39 percent diseased leaves on June 18 compared with 65 percent in the orchard cultivated about four weeks later.

Where cultivation is to be used as a supplementary leaf spot control measure, it will be of most benefit if completed in the early spring before any leaf spot infections occur. This normally means cultivation during bloom or earlier. This will require destruction of the cover crop earlier than sometimes seems desirable, but the time of cultivation can be varied to permit later cover crop growth in orchards where leaf spot is not a severe problem.

Destruction of the fungus in the old leaves by means of ground sprays has been tried in other states. Where cultivation of all or a part of the orchard is not feasible, as on steep hillsides, the grower might try spraying the old leaves on the ground with a sodium dinitro orthocresylate paste (Elgetol, Krenite) at one-half gallon per 100 gallons of spray, using about 500 gallons of spray solution per acre.

The relation of ground inoculum to leaf spot development was clearly revealed in the 1947 Virginia plots. Because of deterioration of the trees, the experimental plots were moved in 1947 from the heavily infected old planting, which had been used for several years, to an isolated eight-year-old block of vigorous trees which had always been kept virtually free of leaf spot by thorough spraying and cultivation. Although 1947 was a severe leaf spot year over the region as a whole, the disease did not appear on any of the checks until midsummer and did not cause appreciable defoliation by October.

CONTROL BY FUNGICIDES

The selection of a satisfactory fungicide for the control of cherry leaf spot is complicated by three major factors. First, protection against leaf spot must be provided through a long growing season and a wide range of weather conditions. Second, the quality of the cherry fruit is influenced by the fungicide used for disease control. The magnitude of this effect on quality varies widely with the fungicide used and with seasonal conditions. Third, some of the fungicides which fulfill the requirements regarding leaf spot control and effect on fruit quality are limited in use because of failure to control other diseases, incompatibility with the lime ordinarily used with lead arsenate, or relative unavailability and high cost. No fungicide has yet proved satisfactory in all respects.

The general response of the tree and fruit to a fungicide appears to prevail over a wide area, but the degree and importance of the response varies with local conditions. For example, the stem-end injury to the fruit caused by the copper fungicides has been greater in Pennsylvania than in Virginia, West Virginia or New York, yet it has occurred in all these states. In view of this, and the complexity and volume of the data accumulated during seven years study of the leaf spot control problem, it is proposed here to outline the general effects of the various fungicides on sour cherries in the Cumberland-Shenandoah Valley.

We have used four-spray, five-spray, and six-spray schedules in our experimental work. With four sprays, the first was applied at petal-fall, followed by a shuck spray about 10 days later, a first cover spray about three weeks after the shuck spray and a fourth spray immediately after harvest in July. With five sprays the first cover during the past three years was moved back closer to the shuck spray, and a second cover or pre-harvest spray applied one to two weeks before harvest. With six sprays the interval between sprays was shortened and five sprays were applied before harvest.

Commonly Used or Standard Materials

Lime-sulfur.—Liquid lime-sulfur has been the most commonly used fungicide for sour cherries in this area for many years, and is usually used at two to three gallons per 100 gallons of spray. It has given far poorer leaf spot control than the copper fungicides. While moderately effective in the spring, it has not given satisfactory control from June until October. It commonly causes severe leaf injury in hot weather, and may cause scalding of the fruit. Fruit dwarfing by lime-sulfur has been about the same as that caused by some of the proprietary copper compounds, and was greatest in the relatively dry summer of 1944 when 17 more cherries were required to make a pound of fruit from lime-sulfur sprayed trees than from unsprayed trees. Lime-sulfur usually causes an increase in the soluble solids content of the juice, the total acidity

and the weight of pits per pound of fruit, all probably due to the dwarfed fruits. Lime-sulfur sprayed fruit holds up much better through a long hot harvest period than fruit sprayed with bordeaux mixture or some of the other copper fungicides. It has caused little or no stem-end injury to the fruit.

Bordeaux mixture.—Bordeaux mixture has been one of the most effective fungicides in leaf spot control. However, it often causes severe injury when used on foliage infested with aphids, or during wet or abnormally dry weather. The fruit is dwarfed more than with any other treatment, is dark red in color and has the highest soluble solids content and one of the highest acid contents. Fruits sprayed with bordeaux mixture shrivel badly during a long hot, dry harvest period; for this reason fruits from these plots were unfit to harvest in 1944.

The fruit dwarfing and shriveling caused by bordeaux mixture are more than sufficient reasons to avoid its use in pre-harvest sprays on bearing trees whenever possible. However, it is a cheap and highly effective fungicide and will probably continue to be a standard treatment for summer sprays on non-bearing trees and for post-harvest sprays on bearing trees.

The proprietary copper fungicides. The proprietary copper fungicides as a group, have been somewhat less effective in leaf spot control than bordeaux mixture. However, they cause less leaf injury and the percentage of leaves remaining on the trees is often as high or higher with one of them than with bordeaux mixture. They cause less fruit dwarfing than bordeaux mixture, but in dry weather they cause more fruit shriveling than lime-sulfur. The proprietary copper fungicides differ to some extent in disease control and injury. Properly used, any of them will give fair to good leaf spot control.

Perhaps the most widely used of this group of materials are Tennessee 26, Copoloid, Copper Hydro, Copper A, Cupro-K, and Bordow. They are used at rates of one-half to three-fourths pound of actual copper in 100 gallons of spray with two to three pounds of hydrated spray lime. Extensive studies on these materials have been reported previously (3).

Greater use of the proprietary copper fungicides are suggested except that they sometimes are associated with an injury to the skin of the fruit which is objectionable in canned cherries. This injury occurs as a black line around the stem of the fruit, but is usually separated from the stem by normal tissue. The injury may or may not form a complete line around the stem, and usually involves only the epidermal layer and two or three layers of cells in the flesh (8).

Although some stem-end injury may be caused by other things, serious injury has been definitely associated with the use of copper fungicides. Some of the data from approximately 100 plots in which this injury has occurred are given in table 2.

Two pertinent experiments may be of interest here. In 1942 Miller (8) used Basicop, Tennessee 26, Cupro-K, and Bordow at .8, .4, .3, and 1.0 pounds of actual copper in 100 gallons of spray. Lead arsenate at two pounds

was included in the first two sprays, and lime at three pounds in all sprays. Three sprays were applied before harvest. Stem-end injury increased with increased copper concentration, and averaged 43.1 percent for Basicop, 44.3 for Tennessee 26, 34.7 for Cupro-K and 25.4 for Bordow. In an experiment in 1943 there was 3.0 percent stem-end injury with Tennessee 26 plus lime and lead arsenate in three sprays before harvest, 0.3 percent with only a petal-fall spray of Tennessee 26 plus lime, 13.1 percent with the same materials only in the shuck spray, 12.5 percent with lead arsenate added in the shuck spray, 2.6 percent with Tennessee 26 plus lime only in the first cover spray and 2.6 percent with lead arsenate added in the first cover spray. Lead arsenate had no effect on the amount of stem-end injury. Tennessee 26 in the petal-fall spray caused little of this injury; about the same amount when used only in the first cover spray as when used in all sprays before harvest; and more than four times as much damage when used only in the shuck spray as when used in all three sprays.

Data reported here can be interpreted on the theory that metallic copper is freed under our weather conditions and the relatively long intervals which often elapse between sprays. Most of the injury has occurred with four-spray schedules. The experience with this injury in New York in 1945 can perhaps be interpreted on the same basis. They had an abnormally long wet season in 1945 and stem-end injury was a severe problem in some orchards.

The Newer Fungicides

Compound 341.—Compound 341 is an organic fungicide in which the principal active fungicidal ingredient is 2-heptadecylglyoxalidine (13). Several experimental formulations have been used and the final one is not yet apparent. The various formulations were generally used in the manner required to give about one pound of active ingredient per 100 gallons of spray, although this was varied in some instances as indicated in this discussion and the attached tables.

Prior to 1946 Compound 341 was outstanding among all the materials used for leaf spot control. We used it in ten experiments over a period of four years. In nine of these experiments, the percentage of leaves remaining on the trees was higher with this than with any other material. It was exceeded by less than three percent by two other materials in the tenth experiment. Leaves sprayed with Compound 341 were a deep green color and showed injury only in 1945 as a moderate bronzing of the lower leaf surface. The material was apparently compatible with lead arsenate, lime, nicotine sulfate and summer oil. It caused no noticeable injury when used following lime-sulfur, bordeaux mixture, Tennessee 26, Isothan Q15, Compound 604 (Phygon), Dirhane, Zerlate, Puratized and others, or when followed by bordeaux mixture, Tennessee 26, Isothan Q15, or Zerlate; nor did it dwarf the fruit. It gave adequate

control of brown rot on the fruit even when 25 to 50 percent of the fruit rotted on unsprayed trees.

Compound 341 showed some minor, but potentially important, weaknesses when used in all sprays throughout the season. The skin of the cherry was a lighter red than that obtained with any other material, dull in color, and tender, with consequent susceptibility to limb rubbing and cracking. These differences were associated with an apparent difference in the fineness or manner of softening of the fruit, with the Compound 341 sprayed fruit tending to remain firmer under the skin and bleeding more when picked. The soluble solids content of the fruit was low, with limited data showing that the solids content was too low to be accounted for by the large fruit.

Compound 341 did not control *Alternaria* rot, a disease of the ripe fruit characterized by a heavy dark growth of the causal fungus over the surface of the depressed, infected areas and which eventually results in a flat-sided dull cherry. In the hot, wet season of 1945 Compound 341 was neither as safe nor as effective as bordeaux mixture when used in a single post-harvest spray following other materials.

The formulation of Compound 341 was changed to an emulsion in 1946 and it was prepared in larger quantities than previously. The emulsion was manufactured to contain one and one fourth pounds of 2-heptadecylglyoxalidine per gallon, the amount most commonly used in 100 gallons of spray. This emulsion failed to give as good leaf spot control as had the older formulations. The leaves on trees sprayed all season with the emulsion were severely bronzed on the lower surface and tended to be stiff and partly folded, in contrast to the usual dark green foliage typical of trees sprayed with the hydrochloride form. There was also some bronzing with the hydrochloride form.

A comparative test of three Compound 341 formulations was made in Pennsylvania in 1946, beginning in midseason with the second cover spray. The 1946 emulsion, the 1945 hydrochloride form and a liquid preparation containing one pound active ingredient in one gallon of isopropanol were used. The emulsion was used at four and six quarts per 100 gallons; the hydrochloride form at 2.7 pounds (one pound active ingredient) and the isopropanol solution at five quarts. Parallel comparisons of Zerlate bordeaux and Tennessee 26 bordeaux were included. The hydrochloride preparation was far more effective in leaf spot control than the emulsion although the former was used at the rate of one pound 2-heptadecylglyoxalidine as against 1.25 and 1.87 pounds of presumed active ingredient for the emulsion. The hydrochloride form was superior to the Zerlate bordeaux and Tennessee 26-bordeaux although the difference was not great. The isopropanol solution was almost equally good.

The control of leaf spot was not significantly affected by increasing the concentration of the emulsion from one to one and one-half gallons in this experiment, or by an increase from one-half to one gallon in Virginia, or by

the addition of Omilite (polyethylene polysulfide) — all indicating that the fundamental trouble with the emulsion form was a lack of toxicity to the leaf spot fungus.

It has been reported that the 2-heptadecylglyoxalidine in the 1946 emulsion hydrolyzed in the presence of water and heat to form the straight chain N-(2-aminoethyl) stearamide¹ (5). It also undergoes hydrolysis in isopropanol, but at a much slower rate than in water.²

Compound 341 emulsion failed to control powdery mildew in two locations when used in all sprays during the season, even though spraying was thorough and timely enough to give nearly perfect leaf spot control. No case was observed where powdery mildew was a problem where Compound 341 emulsion was used only in the first three or four sprays during the season and followed by a copper fungicide.

In grower-sprayed plots, Compound 341 emulsion gave as good results in all cases as the standard treatment and was superior wherever disease and crop conditions permitted comparisons (table 14).

Three points were brought out by these tests. First, in some cases the Compound 341-bordeaux mixture schedule resulted in considerably better leaf spot control, larger fruit and apparently a greater total yield with a higher percentage of No. 1 cherries than the lime sulfur-bordeaux mixture schedule. Second, the Compound 341-sprayed trees were noticeably more vigorous and recovered better from the weakened condition caused by defoliation the previous season. Third, Compound 341 tended to reduce fruit color on the relatively vigorous experimental trees prior to 1946, but this situation was reversed on the weak trees used in these tests. Red color developed earlier on the Compound 341-sprayed fruit than where lime-sulfur was used, and was a deeper red during June. The color difference decreased, however, during late June and early July.

Three new Compound 341 formulations were released under the code letters "A", "B" and "C" in 1947 and were supplied for experimental work in addition to some of the hydrochloride form. The "A" formulation contained 40 percent, and the "B" formulation 33.3 percent glyoxalidines, the balance consisting of inert diluent and wetting agent. These two forms were free-flowing powders. The third or "C" formulation was a liquid supposedly containing 54 percent glyoxalidines as an acetate salt dissolved in isopropanol. The liquid or "C" formulation required the addition of lime to liberate the free base. The dry powders were ready to use upon dispersal in water.

None of the 1947 formulations of Compound 341 was as effective in leaf spot control as was the hydrochloride form. Scalding of the fruit occurred with all four formulations and was frequently severe where the "C" formulation was used (fig. 4). The injury resulting from the use of Compound 341

^{1,2} Letters from R. H. Wellman and N. C. Thornton of Carbide and Carbon Chemicals Corporation dated December 16, 1946 and February 18, 1947.



Figure 4.—Typical fruit injury produced on Montmorency cherry in 1947 by Compound 341-C.

in 1947 was approximately halved by the addition of lead arsenate two pounds and hydrated lime three pounds, and doubled by the addition of Gamtox (six percent gamma isomer of benzene hexachloride) at two pounds. Formula "C" was more effective in leaf spot control and more injurious than "A" or "B".

The Isothans.—Isothan Q15 is a member of a group of allegedly "cationic," surface-active, modified quaternary ammonium compounds and contains the active ingredient lauryl isoquinolinium bromide. In our early tests on cherry this material was more effective in leaf spot control than the related compound Isothan Q70 (a member of the Isothan group containing nicotine) and apparently more effective than Isothan Q4 (active ingredient lauryl pyridinium bromide). At one pint per 100 gallons of solution, Isothan Q15 gave as good

control of leaf spot as lime-sulfur 2-100 early in the season, but failed to control leaf spot late in the season. At one quart plus one pint of Orthex oil sticker, it gave comparatively excellent leaf spot control in 1946 when sprays were being applied at frequent intervals, but failed rapidly during harvest and after mid-August when the spray coverage had not been renewed within two to four weeks. It caused a significant reduction in fruit size in 1945 (12.5 cherries per pound) at one pint and in 1946 at one quart (16.9 and 10.9 cherries per pound), but not in 1944 at 6½ ounces (2.8 cherries per pound). Isothan-sprayed fruit was a slightly darker red than lime-sulfur-sprayed fruit and was more resistant to limb rubbing and cracking.

Isothan Q15 is apparently compatible with lead arsenate, nicotine sulfate and petroleum oils, but is incompatible with lime (table 8) and with many forms of talc, clay, bentonite, soap, lime-sulfur, or any strongly acid or alkaline material.³ The reduced efficiency of Isothan Q15 brought about by the addition of lime can apparently be overcome under some conditions by increasing the concentration of the Isothan.

The Dithiocarbamates.—We have used five of the derivatives of dithiocarbamic acid on cherries: (1) Japanese Beetle Spray (active ingredient tetramethyl thiuram disulfide); (2) Fermate (active ingredient ferric dimethyl dithiocarbamate); (3) Zerlate (active ingredient zinc dimethyl dithiocarbamate); (4) Karbam (active ingredient zinc dimethyl dithiocarbamate) in 1945; and (5) Dithane (active ingredient disodium ethylene bisdithiocarbamate).

Japanese Beetle Spray was used in 1941 and 1942. It gave somewhat better leaf spot control than Fermate in some tests and poorer control in others (3).

Fermate was used in 1941, 1942 and 1943 and discarded because of poor leaf spot control. It caused a significant reduction in fruit size (14.1 cherries per pound) in one of six early tests at one pound, and in 1943 at one and one-half pounds caused an average reduction in fruit size of 13 cherries per pound in Pennsylvania, Virginia and West Virginia. It was tried again in 1946 in order to compare it with Zerlate. It was much less effective in leaf spot control than Zerlate and was the least effective material used.

Zerlate showed some promise in leaf spot control in 1945 and 1946. It was one of three highly effective materials in the control of *Alternaria* fruit rot in 1945 (table 9). It caused a significant reduction in fruit size in 1946 at one and one-half pounds (11.6 and 14.3 cherries per pound) but not in 1945 at one pound (2.4 cherries per pound). In all tests, it caused a yellowing, stiffening and rolling of the leaves when used in two or more sprays. This was not serious enough, however, to preclude the use of this material in one or two June sprays for the control of *Alternaria* rot. Zerlate is incompatible with lime (table 14) and some difficulty will be encountered in using it in the normal type of spray schedule.

³ Letter from T. W. Reed of the California Spray Chemical Corporation dated January 3, 1946.

Karbam (the zinc dimethyl dithiocarbamate) was used in one test (table 5) in 1945 and showed some promise in leaf spot control. We have not tested the ferric dimethyl dithiocarbamate preparation sold under this trade name.

Dithane has shown little or no promise in the control of cherry leaf spot, either alone or with zinc sulfate-lime. It failed to control leaf spot in both 1944 and 1945, and in 1945 was significantly less effective than Zeilate or Karbam.

Compound 604 or Phygon.—Compound 604 is now offered for sale under the trade name of Phygon, and contains the active ingredient 2, 3-dichloro-1, 4-naphthoquinone. It gave good leaf spot control until late in the season when used alone under comparatively mild disease conditions in 1943 and 1944. It gave only fair control under severe disease conditions in 1945 when used with lead arsenate or lead arsenate plus lime. The addition of lime caused a highly significant reduction in leaf spot control. Considerable leaf injury was present in the Pennsylvania plots in 1945 of the type normally associated with excessive use of lead arsenate. This injury was present where lime was used and where it was omitted.

Phygon caused no fruit dwarfing in these tests, and it gave excellent control of *Alternaria* fruit rot in 1945. The fruits remained in comparatively good condition through the harvest season, but were moderately subject to cracking. The material deserves further testing to determine its value in June sprays for combined leaf spot and fruit rot control, and in all sprays before harvest where organic insecticides are used for curculio and maggot control.

Puratized.—Puratized is now offered for sale under the trade name Puratized Agricultural Spray, and has excited considerable discussion during the past two years because of the high order of effectiveness of the active ingredient against the apple scab fungus. The active ingredient is phenyl mercuri triethanol ammonium lactate. This material was only moderately effective in leaf spot control in our tests, and caused a yellowing, stiffening and rolling of the leaves in Pennsylvania in 1945 when used with lead arsenate. The concentrate caused severe blistering of the skin of the sprayer operator even though washed off soon after contact. It is reported to be decreased in effectiveness by lime, by hard water and by sulfur. It probably could not be used in pre-harvest sprays on cherries because there is no mercury tolerance on fruit.

Compounds still strictly in the experimental stage.—These include (1) copper-8 quinolinolate; (2) zinc-8-quinolinolate; (3) Compound 337 (active ingredient 1-hydroxyethyl-2-heptadecylglyoxalidine); and (4) Compound 629 (active ingredient zinc nitrodithioacetate). None of these have shown any particular promise in the tests to date; the first two have received only limited trials.

Compounds which have shown little or no promise on cherries.—The ones not previously mentioned include (1) Compound 552 (a General Aniline experimental organic); (2) Compound 921 (a Carbide and Carbon

experimental organic); (3) Compound 179 (a calcium aluminum chromate); (4) Compound 181 (a basic zinc chromate); (5) Compound 187 (a zinc cerium chromate); and (6) Spergon (active ingredient tetrachlorobenzoquinone).

DISCUSSION

The problem of leaf spot control in this area is so serious that it outweighs all other factors in cherry production. Indeed, the number of tree deaths following the severe leaf spot epiphytotic in 1945 leads one to question the ability of the industry to survive if the disease control problem is not satisfactorily solved.

The lack of one or more highly effective, non-injurious fungicides for sour cherries has contributed to the situation, but has been no more important than improper management of the orchard and the improper use of available spray materials. Until recently, non-bearing trees were either not sprayed at all or sprayed only once or twice each year during slack work-seasons. It still is a general practice to spray cherries after the work on apples and peaches is completed. This lack of close timing of the sprays increases the strain on the fungicide. The problem is further intensified by our relatively long season and high temperature, and by the extremely heavy population of the leaf spot fungus in many orchards.

These investigations have served to further emphasize the necessity for giving appropriate weight to spray injury, effect of the fungicides on fruit quality and seasonal variations in the development of a spray schedule. We have paid increasing attention to the effect of fungicides on fruit quality, with the basic idea of determining the kind and degree of these effects to facilitate the compromises necessary in preparing and using a spray schedule. These effects are logically of a secondary nature to leaf spot control, but their magnitude is such that the general problem of developing a satisfactory spray schedule for sour cherries will not be solved until fruit dwarfing, at least, can be largely eliminated.

We have aimed toward elimination of fruit dwarfing because of its marked effect on yield and market grade. However, this aim has been tempered somewhat by experience. Our data show that acceptance of either large or small fruit carries with it necessary acceptance, to some degree, of a series of attendant fruit characters.

For example, covariance analyses of the 1944 Virginia data showed a positive correlation of $+0.623$ between the number of cherries per pound and the percentage of soluble solids in the juice ($+0.779$ in Pennsylvania), a correlation of $+0.661$ between the number of cherries per pound and the percentage of acid in the juice, a correlation of $+0.518$ between the number of cherries per pound and the weight of pits per pound of fruit ($+0.679$ in Pennsylvania), and a correlation of $+0.718$ between the percentage of solids

and percentage of acid in the juice. These correlations were all highly significant statistically.

Thus large fruits are apt to be low in soluble solids, acid, and percentage of the total weight discarded as pits. With present spray materials, large fruits may also be expected to be low in color in comparison with the smaller fruits produced with materials such as bordeaux mixture, the proprietary copper fungicides, Isothian Q15 and lime-sulfur. Limited data show that large fruits are more apt to crack in wet weather than small fruits.

It was reported earlier (3) that some fungicides, especially bordeaux mixture, caused an actual increase in weight of soluble solids in the fruit. Additional data have verified this conclusion in that the increase in percentage solids could not be explained entirely on comparative fruit size. The differences between treatments are evidently partly apparent and partly real.

Cherry canners in this area have placed considerable emphasis on high fruit color and solids content, although those who pack cherries for freezing prefer a light colored cherry. Highly colored cherries make a more attractive pie after the usual color fading during processing. A variation in solids content from 14 to 18 percent may mean a difference of 11,500 No. 10 cans of cherries that can be obtained from a million pounds of fresh fruit.⁴ Possible gain from high color and solids content are partially offset, however, by decreased pitter capacity with small fruit, increased waste and the knowledge that sour cherries are sometimes too sweet for best quality. The canners welfare is inseparably related to the general welfare of the growers and a continued supply of fruit.

Our data and observations show that we need two or three different fungicides in our cherry spray program. Bordeaux mixture has given generally satisfactory results in the sprays after harvest. In the sprays before harvest, one of three programs is now (1947) followed by most growers: (1) lime-sulfur in the early-season sprays followed by bordeaux mixture or a proprietary copper fungicide in the last spray before harvest; (2) a proprietary copper fungicide in all sprays before harvest; or (3) Compound 341 in the early-season sprays followed by bordeaux mixture or a proprietary copper fungicide in the last spray before harvest. Most of the advantages and disadvantages of these programs are apparent from the previous discussion of materials.

With Compound 341, a suitable formulation must be prepared and standardized before its place in the cherry spray program can be determined. It is doubtful if any of these spray programs can be depended on to give satisfactory control under all conditions unless combined with suitable sanitary measures.

⁴ The weight of fresh fruit necessary for a definite cut-out weight per can after processing decreases as the solids content of the fruit increases.

APPENDIX

(With Tables)

A memorandum of uniform procedure (3, 12), was agreed on at the time these investigations were initiated. One of the objects of the cooperative attack was to provide a basis for securing greater uniformity in recommendation; so most of the experimental plots were duplicated in each of three states during the first four years. The procedure was changed in 1944 to a more general form of collaboration between workers. The basic procedure was adhered to and frequent consultation continued, but fewer treatments were similar in all experiments. Each worker undertook preliminary investigation of some new material or other phases of the problem.

All experiments were conducted on the variety Montmorency.

The plots consisted of seven randomized single-tree replicates, with data usually taken from six. The extra tree was allowed for possible loss due to unforeseen circumstances.

All proprietary fungicides were obtained from a single plant batch where possible.

Regular acid lead arsenate was used wherever lead arsenate was required. The brand varied with different experiments and seasons.

Gold Bond spray lime was used where lime was indicated. This is a high calcium hydrate prepared specially for spray use.

The sprays were applied from the ground at about 500 pounds pressure using from 6 to 12 gallons per tree depending on tree size.

The spray schedules are given in detail in the attached tables. The sprays were timed by tree development, weather conditions and the number of sprays required for the type of schedule under consideration. The first application was made immediately after most of the petals had fallen, and the last as soon as practicable after the completion of picking.

Defoliation records were taken in the following manner: usually in June and prior to the first wave of leaf fall due to leaf spot, six well distributed branches per tree were tagged at a point back of 50 leaves. The terminal bud was removed whenever necessary to prevent further growth, or a second tag placed so that the two bracketed the desired 50 leaves. The small, weak or otherwise unsuitable leaves were removed. Each tagged branch constituted a station and was numbered for identification. Counts of the number of leaves remaining and the number of infected leaves per station were made at intervals of approximately one month until early October. Unless otherwise indicated the data given are those obtained about October 1.

The effects of the spray materials on various fruit characters were determined on random samples gathered from each tree at harvest. Samples from one or two replicates were picked in the morning, the various tests completed that day, and further samples collected each day until the harvest records

were completed. With one exception, all fruit data given for any particular treatment were obtained from a single sample per tree. Two samples were used in Pennsylvania in 1945 as indicated in table 9.

Fruit size was recorded through counting the number of fruits per pound using a pound sample per tree.

The soluble solids content was determined by means of refractometer readings using the juice from each fruit sample. The pressure used to obtain the juice was that required to crack one or more pits in the sample. Table-model, microscope-type refractometers were used in Pennsylvania and Virginia. A hand refractometer was used in West Virginia. Comparison indicated that the work could be done satisfactorily with either type of instrument.

The titratable acidity was determined as follows: the juice from about one-third pound of fruit taken from a random one- to two-pound sample per tree was treated as a unit or combined with other lots to give a composite sample for each treatment. An aliquot of 50 milliliters of juice was filtered through No. 1 Whatman filter paper, and a 25 milliliter aliquot of filtered juice decolorized with one level teaspoonful of Nuchar active carbon No. C-145 for decolorizing. The juice was then filtered through No. 2 Whatman filter paper to remove the carbon, and 5 milliliter aliquots titrated against approximately 0.1 normal sodium hydroxide using phenolphthalein as an indicator. The titratable acidity was then calculated as percentage malic acid.

The pH of the juice in the samples indicated above, or prepared in the same manner, was determined with a Beckman pH meter before filtration. The readings for each sample were converted to hydrogen ion concentration in terms of normality, averaged, and reconverted to pH.

The data on pit weights and volume, and the data in table 9 on fruit defects at the end of the harvest season, were obtained using one pound samples from each tree. Prior to weighing the pits, most of the adhering flesh was removed in 1943 by washing and scrubbing against wire, and in 1944 all flesh was removed by this procedure plus soaking in either acid or alkali. Pit volume was determined by water displacement.

All statistical calculations were made following methods described by Livermore (7), Snedecor (10), and Roessler (9). The least significant differences between means for odds of 19:1 and 99:1 as determined by the analysis-of-variance method are given at the bottom of each table. Least differences are not given for the two- or three-state averages because homogeneity analyses indicated a differential response of the treatments in different states. The data from six replicates per treatment were used in the analyses in most cases. The yield data given in table 8 were taken from five replicates and those in table 13 from seven. The data from the check or unsprayed trees were normally included in the analyses, but were not used with the leaf data from any state in 1945, or the leaf data in Virginia in 1946.

Table 1.—1913 spray schedules. Materials and rates of usage.¹

Plot	Petal-fall	Shuck	First cover	Pre-harvest	Post-harvest
0	No spray	No spray	No spray	No spray	No spray
1	Lime-sulfur, 2 gal.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	No spray	Lime-sulfur, 2 gal.
2	Lime-sulfur, 2 gal.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	No spray	Bordeaux 2 8-100
3	Lime-sulfur, 2 gal.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Bordeaux 2-8 100; lead, 2.	No spray	Bordeaux 2-8-100
4	Lime-sulfur, 2 gal.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Tennessee 26, 2; lime, 3.	Tennessee 26, 2; lime, 3.
5	Lime-sulfur, 2 gal.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Tennessee 26, 2; lead, 2; lime, 3.	No spray	Tennessee 26, 2; lime, 3.
6	Tennessee 26, 2; lime, 3.	Tennessee 26, 2; lead, 2; lime, 3.	Tennessee 26, 2; lead, 2; lime, 3.	No spray	Tennessee 26, 2; lime, 3.
7	Tennessee 26, 2; zinc sulfate, 4; lime, 3.	Tennessee 26, 2; zinc sulfate, 1/4; lead, 2; lime, 3.	Tennessee 26, 2; zinc sulfate, 3/4; lead, 2; lime, 3.	No spray	Tennessee 26, 2; zinc sulfate, 1/4; lime, 3.
8	Copper Hydro, 2; lime, 3.	Copper Hydro, 2; lead, 2; lime, 3.	Copper Hydro, 2; lead, 2; lime, 3.	No spray	Copper Hydro, 2; lime, 3.
9	Bordow, 4; lime, 3.	Bordow, 4; lead, 2; lime, 3.	Bordow, 4; lead, 2; lime, 3.	No spray	Bordow, 4; lime, 3.
10	Bordeaux 2 8-100	Bordeaux 2-8-100; lead, 2.	Bordeaux 2-8-100; lead, 2.	No spray	Bordeaux 2-8-100
11	Lime-sulfur, 2 gal.	Compound 341, 1 gal. 20% suspension	Compound 341, 1 gal. 20% suspension	Compound 341, 1 gal. 20% suspension	Compound 341, 1 gal. 20% suspension
12	Lime-sulfur, 2 gal.	Compound 921, 1 lb.	Compound 921, 1 lb.	Compound 921, 1 lb.	Compound 921, 1 lb.
13	Lime-sulfur, 2 gal.	Fermate, 1 1/2; lime, 1 1/2.	Fermate, 1 1/2; lime, 1 1/2.	Fermate, 1 1/2; lime, 1 1/2.	Fermate, 1 1/2; lime, 1 1/2.
14	Lime-sulfur, 2 gal.	Fermate, 1; Mike sulfur, 3; lime, 1 1/2.	Fermate, 1; Mike sulfur, 3; lime, 1 1/2.	Fermate, 1; Mike sulfur, 3; lime, 1 1/2.	Fermate, 1; Mike sulfur, 3; lime, 1 1/2.
15	Tennessee 26, 2; lime, 3.	No spray	No spray	No spray	No spray
16	No spray	Tennessee 26, 2; lime, 3.	No spray	No spray	No spray
17	No spray	Tennessee 26, 2; lead, 2; lime, 3.	No spray	No spray	No spray
18	No spray	No spray	Tennessee 26, 2; lime, 3.	No spray	No spray
19	No spray	No spray	Tennessee 26, 2; lead, 2; lime, 3.	No spray	No spray

¹ All formulæ are expressed in pounds per 100 gallons unless noted otherwise. Lead refers to acid lead arsenate and lime to hydrated spray lime.

Table 2.—Summary of data for 1913. See table 1 for complete schedule of treatments.

Percentage leaves remaining and percentage remaining leaves disease-free of 300 originally tagged per tree																					
Plot	Remaining				Disease-free				Mean number fruits per pound				Percentage of soluble solids in juice				pH of juice	Grams pitha weight per fruit	Stem-end injury		
	Pa. Va. W. Va. Avg.				Pa. Va. Avg.				Pa. Va. W. Va. Avg.				Pa. Va. W. Va. Avg.						Mean angle	Percentage	
	Pa.	Va.	W.	Va.	Avg.	Pa.	Va.	Avg.	Pa.	Va.	W.	Va.	Avg.	Pa.	Va.	W.	Va.				Avg.
1	35.1	24.6	46.8	35.5	1.9	0.0	4.7	126.7	116.5	118.5	121.2	121.5	15.7	15.7	15.3	15.3	3.32	19.6	385.2	1.40	0.06
2	77.2	56.7	59.9	64.6	64.4	22.2	38.5	139.5	118.0	126.7	128.7	129.7	15.7	15.7	15.8	15.3	3.41	31.7	377.9	1.00	0.00
3	77.2	56.7	59.9	64.6	64.4	22.2	38.5	139.5	118.0	126.7	128.7	129.7	15.7	15.7	15.8	15.3	3.41	31.7	377.9	1.00	0.00
4	71.8	53.6	62.3	60.9	59.3	41.4	19.8	145.2	124.7	128.2	133.7	137.2	17.1	17.1	17.2	17.2	3.13	49.1	370.1	1.87	0.11
5	29.2	73.9	67.4	73.3	63.2	41.0	52.6	140.8	114.7	121.2	125.6	125.6	16.3	16.3	16.3	16.3	3.43	40.5	359.3	0.80	0.02
6	72.1	74.1	77.3	73.9	47.4	29.2	38.3	141.8	124.3	122.5	129.5	129.5	16.2	16.2	16.7	16.5	3.44	50.0	354.3	7.39	1.65
7	71.6	79.6	77.1	78.7	63.0	71.5	66.2	143.0	115.0	124.3	127.5	127.5	17.2	16.6	16.9	16.9	3.47	49.5	348.1	110.00	8.01
8	80.9	78.7	76.1	78.7	55.0	79.2	67.1	136.2	108.0	125.8	124.3	124.3	16.8	16.6	16.6	16.8	3.43	41.3	381.1	12.02	4.34
9	73.3	71.3	79.0	74.6	59.2	81.7	70.5	143.8	109.5	116.3	123.2	123.2	17.1	16.5	16.9	16.8	3.43	51.3	358.4	12.97	5.04
10	73.3	71.3	79.0	74.6	59.2	81.7	70.5	143.8	109.5	116.3	123.2	123.2	17.1	16.5	16.9	16.8	3.43	51.3	358.4	12.97	5.04
11	63.3	72.6	70.2	72.4	67.6	66.3	90.6	168.7	128.3	136.2	141.1	141.1	19.7	18.5	18.7	18.9	3.46	50.9	322.6	11.52	3.99
12	86.7	90.1	88.1	88.2	75.2	91.0	83.1	130.7	101.7	118.8	117.1	117.1	13.7	15.2	14.7	15.2	3.48	52.0	398.1	1.00	0.00
13	73.3	66.6	61.6	68.3	49.1	37.6	43.6	145.8	124.0	132.7	134.2	134.2	16.6	16.9	16.1	16.5	3.33	52.2	360.1	0.79	0.02
14	78.9	64.0	61.9	68.3	49.1	37.6	43.6	145.8	124.0	132.7	134.2	134.2	16.6	16.9	16.1	16.5	3.33	52.2	360.1	0.79	0.02
15	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
16	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
17	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
18	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
19	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
20	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
21	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
22	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
23	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
24	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
25	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
26	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
27	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
28	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
29	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
30	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
31	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
32	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
33	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
34	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
35	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
36	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
37	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
38	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
39	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
40	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
41	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
42	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
43	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
44	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
45	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
46	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
47	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
48	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
49	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
50	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
51	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
52	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
53	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
54	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
55	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4	1.11	0.04
56	76.2	80.2	80.2	78.9	56.7	59.0	57.9	147.8	119.2	128.2	131.7	131.7	16.7	15.8	16.5	16.3	3.44	53.0	359.4		

Table 3.—1944 spray schedules. Materials and rates of usage.

Plot	Petal-fall	Shuck	First cover	Pre-harvest	Post-harvest
0	No spray	No spray	No spray	No spray	No spray
1	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal. 20% suspension.	Comp. 341, 1 gal. 20% suspension.	Comp. 341, 1 gal. 20% suspension.	Comp. 341, 1 gal. 20% suspension.
2	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Comp. 341 hydrochloride, 1½; lime, 0.15.	Comp. 341 hydrochloride, 1½; lime, 0.15.	Comp. 341 hydrochloride, 1½; lime, 0.15.	Comp. 341 hydrochloride, 1½; lime, 0.15.
3	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Comp. 341 hydrochloride, 1½; lead, 2; lime, 3.	Comp. 341 hydrochloride, 1½; lead, 2; lime, 3.	Comp. 341 hydrochloride, 1½; lead, 2; lime, 3.	Comp. 341 hydrochloride, 1½; lead, 2; lime, 3.
4	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Comp. 341 hydrochloride, 0.63; lime, 0.08.	Comp. 341 hydrochloride, 0.63; lime, 0.08.	Comp. 341 hydrochloride, 0.63; lime, 0.08.	Comp. 341 hydrochloride, 0.63; lime, 0.08.
5	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	HE 175 (Diathane), 1.	HE 175 (Diathane), 1.	HE 175 (Diathane), 1.	HE 175 (Diathane), 1.
6	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	HE 175, 1; zinc sulfate (flake), ½; lime, 1.	HE 175, 1; zinc sulfate (flake), ½; lime, 1.	HE 175, 1; zinc sulfate (flake), ½; lime, 1.	HE 175, 1; zinc sulfate (flake), ½; lime, 1.
7	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Puritized N5 X, 11 oz.	Puritized N5 X, 11 oz.	Puritized N5 X, 11 oz.	Puritized N5 X, 11 oz.
8	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Isoban, Q 4, 6½ oz.	Isoban Q 4, 6½ oz.	Isoban Q 4, 6½ oz.	Isoban Q 4, 6½ oz.
9	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Isoban Q 15, 6½ oz.	Isoban Q 15, 6½ oz.	Isoban Q 15, 6½ oz.	Isoban Q 15, 6½ oz.
10	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Comp. 604, 1.	Comp. 604, 1.	Comp. 604, 1.	Comp. 604, 1.
11	Bordeaux, 4; lead, 2; lime, 3.	Bordeaux, 4; lead, 2; lime, 3.	Bordeaux, 4; lime, 3.	Bordeaux, 4; lime, 3.	Bordeaux, 4; lime, 3.
12	Tennessee 26, 2; lead, 2; lime, 3.	Tennessee 26, 2; lead, 2; lime, 3.	Tennessee 26, 2; lead, 2; lime, 3.	Tennessee 26, 2; lime, 3.	Tennessee 26, 2; lime, 3.
13	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lime, 3.	Lime-sulfur, 2 gal.; lime, 3.
14	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Bordeaux 1½, 6-100	Bordeaux 1½, 6-100
15	Bordeaux, 1½, 6-100; lead, 2; lime, 3.	Bordeaux, 1½, 6-100; lead, 2; lime, 3.	Bordeaux 1½, 6-100; lead, 2; lime, 3.	Bordeaux 1½, 6-100	Bordeaux 1½, 6-100
16	Tennessee 26, 2; lead, 2; lime, 3.	Tennessee 26, 2; lead, 2; lime, 3.	Tennessee 26, 2; lead, 2; lime, 3.	None	Tennessee 26, 2; lime, 3.
17	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Bordeaux 1½, 6-100; lead, 2; lime, 3.	None	Bordeaux 1½, 6-100

Schedule 13 did not include lime in the pre-harvest and post-harvest sprays in Pennsylvania.

Table 5.—1945 spray schedules. Materials and rates of usage in Virginia.

Plot	Petal-fall	Shuck and first cover	Pre-harvest sprays ¹	Post-harvest
0	No spray	No spray	No spray	No spray
1	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.	Lime-sulfur, 2 gal.
2	Bordeaux 1½, 4 100; lead, 2.	Bordeaux 1½, 4 100; lead, 2.	Bordeaux 1½, 4 100	Bordeaux 1½, 4 100
3	Tennessee 26, 2; lead, 2; lime, 3.	Tennessee 26, 2; lead, 2; lime, 3.	Tennessee 26, 2; lime, 3.	Tennessee 26, 2; lime, 3.
4	Bordow, 4; lead, 2; lime, 3.	Bordow, 4; lead, 2; lime, 3.	Bordow, 4; lime, 3.	Bordow, 4; lime, 3.
5	Comp. 341, 2; lime, 88 grams.	Comp. 341, 2; lime, 88 grams.	Comp. 341, 2; lime, 88 grams.	Comp. 341, 2; lime, 88 grams.
6	Comp. 341, 2; lime, 88 grams.	Comp. 341, 2; lime, 88 grams.	Comp. 341, 2; lime, 88 grams.	Comp. 341, 2; lime, 88 grams.
7	Puritized NaD, 380 ml.; lead, 2.	Puritized NaD, 380 ml.; lead, 2.	Puritized NaD, 380 ml.	Puritized NaD, 380 ml.
8	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1.	Comp. 604, 1.
9	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Isathan Q70, 16 oz.	Isathan Q70, 16 oz.	Bordeaux 1½, 4 100
10	Isathan Q15, 12 oz.; lead, 2; lime, 3.	Isathan Q15, 12 oz.; lead, 2; lime, 3.	Isathan Q15, 12 oz.	Bordeaux 1½, 4 100
11	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Karham, 1	Karham, 1	Bordeaux 1½, 4 100
12	Dithane D14, 43 oz.; zinc sulfate, ½; lead, 2; lime, 1.	Dithane D14, 43 oz.; zinc sulfate, ½; lead, 2; lime, 1.	Dithane D14, 43 oz.; zinc sulfate, ½; lime, 1.	Bordeaux 1½, 4 100

¹ Two sprays.

Table 6.—Summary of data for 1945. See table 5 for complete schedule of treatments in Virginia.

Percentage leaves remaining and percentage remaining leaves disease-free of 300 originally tagged per tree								
Plot	July 3-5		August 3		September 1		September 29	
	Remain- ing	Disease- free	Remain- ing	Disease- free	Remain- ing	Disease- free	Remain- ing	Disease- free
0-----	2.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0
1	94.9	87.2	46.6	5.5	3.3	0.0	0.0	0.0
2	78.8	84.3	69.5	70.5	27.2	9.5	0.6	0.0
3	94.7	90.9	83.9	74.5	42.9	21.1	8.7	0.0
4	90.4	86.3	70.9	54.3	18.2	3.5	1.1	0.0
5	97.5	91.7	89.4	72.1	67.4	46.7	21.4	0.0
6	97.9	96.3	95.0	84.8	78.7	49.0	16.2	0.0
7	89.8	92.3	76.9	67.3	42.1	12.8	1.1	0.0
8	86.6	89.8	57.9	28.9	26.1	9.1	2.5	0.0
9	70.6	40.5	22.2	0.8	3.3	0.0	0.0	0.0
10	80.9	78.3	46.2	18.9	13.8	3.0	0.0	0.0
11	86.2	82.1	60.2	50.9	6.1	0.0	0.0	0.0
12	45.3	29.9	12.4	7.4	0.2	0.0	0.0	0.0
L. D. 19:1	10.8	12.5	18.7	20.1	18.0	13.2	7.4	-----
99:1	14.4	16.6	24.9	26.8	24.0	17.6	9.8	-----

Table 7.—1945 spray schedules. Materials and rates of usage in Pennsylvania.

Plot	Petal-fall	Shuck	First cover	Pre-harvest Sprays	Post-harvest
0	No spray	No spray	No spray	No spray	No spray
1	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.	Lime-sulfur, 2 gal.
2	Bordeaux 1½, 4 100; lead, 2; Tennessee 26, 2; lead, 2; lime, 3.	Bordeaux 1½, 4 100; lead, 2; Tennessee 26, 2; lead, 2; lime, 3.	Bordeaux 1½, 4 100; lead, 2; Tennessee 26, 2; lead, 2; lime, 3.	Bordeaux 1½, 4 100 Tennessee 26, 2; lime, 3.	Bordeaux 1½, 4 100 Tennessee 26, 2; lime, 3.
3	Comp. 552, 2 lbs.	Comp. 552, 2	Comp. 552, 2	Comp. 552, 2	Comp. 341, 2; 7; lime, 88 gms.
4	Comp. 341, 2; 7; lime, 88 gms.	Comp. 341, 2; 7; lime, 88 gms.	Comp. 341, 2; 7; lime, 88 gms.	Comp. 341, 2; 7; lime, 88 gms.	Comp. 341, 2; 7; lime, 88 gms.
5	Comp. 341, 2; 7; lime, 88 gms.	Comp. 341, 2; 7; lime, 88 gms.	Comp. 341, 2; 7; lime, 88 gms.	Comp. 341, 2; 7; lime, 88 gms.	Comp. 341, 2; 7; lime, 88 gms.
6	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1	Comp. 341, 2; 7; lime, 88 gms.
7	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1	Comp. 341, 2; 7; lime, 88 gms.
8	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1; lead, 2; lime, 3.	Comp. 604, 1	Comp. 341, 2; 7; lime, 88 gms.
9	Isiothan Q 15, 1 pt.; lead, 2; lime, 3.	Isiothan Q 15, 1 pt.; lead, 2; lime, 3.	Isiothan Q 15, 1 pt.; lead, 2; lime, 3.	Isiothan Q 15, 1 pt.	Comp. 341, 2; 7; lime, 88 gms.
10	Isiothan Q 15, 1 pt.; lead, 2; lime, 3.	Isiothan Q 15, 1 pt.; lead, 2; lime, 3.	Isiothan Q 15, 1 pt.; lead, 2; lime, 3.	Isiothan Q 15, 1 pt.	Comp. 341, 2; 7; lime, 88 gms.
11	Diathane, ½ gal.; zinc sulfate, ½; lead, 2; lime, 1.	Diathane, ½ gal.; zinc sulfate, ½; lead, 2; lime, 1.	Diathane, ½ gal.; zinc sulfate, ½; lead, 2; lime, 1.	Diathane, ½ gal.; zinc sulfate, ½; lime, 1.	Comp. 341, 2; 7; lime, 88 gms.
12	Zerlate, 1; lead, 2; lime, 3.	Zerlate, 1; lead, 2; lime, 3.	Zerlate, 1; lead, 2; lime, 3.	Zerlate, 1	Comp. 341, 2; 7; lime, 88 gms.
13	Puritized N5D, 380 ml.; lead, 2; lime, 3.	Puritized N5D, 380 ml.; lead, 2; lime, 3.	Puritized N5D, 380 ml.; lead, 2; lime, 3.	Puritized N5D, 380 ml.	Comp. 341, 2; 7; lime, 88 gms.
14	Comp. 341, 2; 7; lead, 2; lime, 3.	Comp. 341, 2; 7; lead, 2; lime, 3.	Comp. 341, 2; 7; lead, 2; lime, 3.	Isiothan Q 15, 1 pt.	Comp. 341, 2; 7; lime, 88 gms.
15	Comp. 179, 1; lead, 2; lime, 3.	Comp. 179, 1; lead, 2; lime, 3.	Comp. 179, 1; lead, 2; lime, 3.	Comp. 179, 1; lime, 3.	Comp. 179, 1; lime, 3.
16	Comp. 181, 1; lead, 2; lime, 3.	Comp. 181, 1; lead, 2; lime, 3.	Comp. 181, 1; lead, 2; lime, 3.	Comp. 181, 1; lime, 3.	Comp. 181, 1; lime, 3.
17	Comp. 187, 1; lead, 2; lime, 3.	Comp. 187, 1; lead, 2; lime, 3.	Comp. 187, 1; lead, 2; lime, 3.	Comp. 187, 1; lime, 3.	Comp. 187, 1; lime, 3.

Table 8.—Summary of data for 1945 with some residual effects observed in 1946.
See table 7 for complete schedule of treatments in Pennsylvania.

Percentage leaves remaining and percentage remaining leaves disease- free of 300 originally tagged per tree.					Increase in trunk circumference				Yield in pounds per tree in 1946	Percent No. 1 fruits at harvest in 1946
June 28-29		October 3-4		1945		1946				
Plot	Remain- ing	Disease- free	Remain- ing	Disease- free	Milli- meters	Percent	Milli- meters	Percent		
0-----	34.8	8.1	0.0	0.0	23.2	6.1	46.2	11.4	36.2	56
1-----	92.8	69.9	0.0	0.0	28.0	7.7	51.6	12.8	67.1	
2-----	86.2	46.3	45.3	9.3	54.2	14.6	55.6	12.6	80.2	
3-----	87.1	44.7	34.3	3.4	50.5	13.4	48.6	11.2	76.8	
4-----	61.6	21.1	0.0	0.0	35.5	9.7	48.8	12.4	26.9	
5-----	99.3	93.0	95.4	21.1	57.3	15.4	43.2	9.8	107.0	79
6-----	98.8	83.0	87.8	7.4	59.3	15.5	55.2	12.2	86.9	
7-----	92.2	66.7	31.6	0.5	47.5	12.8	46.4	10.9	74.9	
8-----	86.2	42.3	28.3	0.1	47.3	12.0	48.2	11.3	74.3	
9-----	92.7	65.4	33.7	0.0	54.7	13.8	44.2	9.9	95.6	
10-----	80.6	33.7	21.8	0.0	48.3	12.1	48.2	10.5	79.4	
11-----	84.8	46.8	20.7	0.0	44.7	11.9	47.8	11.5	70.6	
12-----	92.3	74.2	46.5	3.2	43.5	11.2	43.6	10.0	93.1	
13-----	91.6	56.3	36.8	0.5	46.7	13.6	45.0	11.3	64.3	
14-----	97.7	79.0	32.4	0.1	52.7	14.5	49.4	13.4	62.7	
15-----	54.4	8.0	0.0	0.0	24.7	6.4	57.0	14.3	45.9	
16-----	82.4	26.5	0.2	0.0	29.0	7.8	44.8	11.2	54.7	
17-----	78.2	35.1	0.8	0.0	29.2	7.4	45.2	10.4	81.9	
L. D. 19:1	9.3	11.7	14.7	5.5	10.9	2.9	No significant differences		32.9	
99:1	12.3	15.5	19.5	7.3	14.4	3.9			43.7	

Table 9.—Summary of data for 1945. See table 7 for complete schedule of treatments in Pennsylvania.

Plot	Fruit defects at end of harvest season, July 19-20, 1945. Given as percentages									
	Mean number fruits per pound	Percent-age of soluble solids in fruits	Percent-age malic acid in fruits	Ratio Acid: Solids	Free of defects	Alter-naria rot	Limb rub	Cracked	Brown rot	Shriveled
0	110.3	11.0	.8694	1:12.7						
1	117.3	14.6	1.0900	1:13.4	67.1	10.6	12.0	10.6	0.2	0.0
2	137.2	18.0	1.0900	1:16.5						
3	130.3	16.0	.9732	1:16.4	71.9	6.6	15.4	3.2	0.5	0.9
4	116.8	13.3	.9083	1:14.6						
5	109.3	13.8	.9472	1:14.6	34.8	16.3	21.2	29.0	1.0	0.0
6	111.8	13.8	.8953	1:15.4						
7	110.8	14.0	.8369	1:16.7	71.9	3.2	7.6	11.5	1.1	0.6
8	112.3	14.3	.8953	1:16.0						
9	122.8	15.0	.9843	1:16.1	73.4	8.3	7.6	3.2	2.1	4.2
10	109.5	13.9	.8175	1:17.0						
11	115.8	15.0	.8175	1:18.3	78.1	5.5	9.1	4.3	1.4	0.5
12	112.7	14.8	.8369	1:17.7	76.1	3.7	7.6	3.2	0.5	8.7
13	108.5	14.5	.7785	1:18.6	74.5	3.7	6.1	13.2	1.3	9.8
14	118.8	14.5	.9343	1:15.5						
15	120.2	14.2	.9083	1:15.6						
16	119.3	14.7	.9278	1:15.8						
17	121.7	15.1	.8759	1:17.2						
Odd	114.7	14.8	.9732	1:15.2						
L. D. 19:1	7.8	8			9.8	2.7	5.4	5.3	1.2	3.1
99:1	10.3	1.1			13.2	3.6	7.3	7.1	1.6	4.2

¹ 2 sprays of lime-sulfur at 2 gallons followed by 3 sprays of Isothian Q15 at 1 pint, followed by a post-harvest spray of Compound 341 at 2.7 pounds plus 88 grams of lime.

² Composite samples titrated in duplicate.

Table 10.—1946 spray schedules. Materials and rates of usage in Virginia.

Plot	Pre-harvest	Shuck	First cover	Second cover	Post-harvest
0	No spray	No spray	No spray	No spray	No spray
1	Lime-sulfur, 2 gal.	Lime-sulfur, 2 gal.; lead, 2; lime, 3	Lime-sulfur, 2 gal.; lead, 2; lime, 3	Bordeaux 1½-4-100; lead, 2.	Bordeaux 2-6-100
2	Comp. 341, 1 gal.	Comp. 341, 1 gal.; Gamtox, 3 lb.	Comp. 341, 1 gal.; lead, 2; lime, 3	Bordeaux 1½-4-100; lead, 2.	Bordeaux 2-6-100
3	Comp. 341, 1 gal.	Comp. 341, 1 gal.; Gamtox, 3 lb.	Comp. 341, 1 gal.; lead, 2; lime, 3	Isothan Q-15, 1 qt.; lead, 2; lime, 3	Bordeaux 2-6-100
4	Comp. 341, 1 gal.	Comp. 341, 1 gal.; Gamtox, 3 lb.	Comp. 341, 1 gal.; lead, 2; lime, 3	Zerlate, 1½ lb.; lead, 2.	Bordeaux 2-6-100
5	Comp. 341, 1 gal.	Comp. 341, 1 gal.; Gamtox, 3 lb.	Comp. 341, 1 gal.; lead, 2; lime, 3	Bordow, 4 lb.; lead, 2; lime, 6.	Bordow, 4 lb.; lime, 6.
6	Comp. 341, 1 gal.	Comp. 341, 1 gal.; Gamtox, 3 lb.	Comp. 341, 1 gal.; lead, 2; lime, 3	Comp. 341, 1 gal.; lead, 2; lime, 3	Comp. 341, 1 gal.
7	Comp. 341, ½ gal.	Comp. 341, ½ gal.; Gamtox, 3 lb.	Comp. 341, ½ gal.; lead, 2; lime, 3	Comp. 341, ½ gal.; lead, 2; lime, 3	Comp. 341, ½ gal.
8	Comp. 341, ½ gal.; Omilite, 1 qt.	Comp. 341, ½ gal.; Omilite, 1 qt.; Gamtox, 3 lb.	Comp. 341, ½ gal.; Omilite, 1 qt.; lead, 2; lime, 3	Comp. 341, ½ gal.; Omilite, 1 qt.; lead, 2; lime, 3	Comp. 341, ½ gal.; Omilite, 1 qt.
9	Comp. 341, ½ gal.; Isothan Q-15, 1 pt.	Comp. 341, ½ gal.; Isothan Q-15, 1 pt.; Gamtox, 3 lb.	Comp. 341, ½ gal.; Isothan Q-15, 1 pt.; lead, 2; lime, 3	Comp. 341, ½ gal.; Isothan Q-15, 1 pt.; lead, 2; lime, 3	Comp. 341, ½ gal.; Isothan Q-15, 1 pt.
10	Comp. 629, 1½ qts.	Comp. 629, 1½ qts.; Gamtox, 3 lb.	Comp. 629, 1½ qts.; lead, 2; lime, 3	Comp. 629, 1½ qts.; lead, 2; lime, 3	Comp. 629, 1½ qts.
11	Comp. 337, 5 qts.	Comp. 337, 5 qts.; Gamtox, 3 lb.	Comp. 337, 5 qts.; lead, 2; lime, 3	Comp. 337, 5 qts.; lead, 2; lime, 3	Comp. 337, 5 qts.
12	Tennessee, 26, 2; lime, 3.	Tenn. 26, 2; lead, 2; lime, 3.	Tenn. 26, 2; lead, 2; lime, 3.	Tenn. 26, 2; lead, 2; lime, 3.	Tenn. 26, 2; lime, 3.

Table 11.—Summary of Virginia data for 1946. See table 10 for complete schedule of treatments.

Percentage leaves remaining and percentage leaves disease-free of 300 originally tagged per tree.							Mean number fruits per pound	Percent- age of soluble solids in fruits	
Date	August 5-6		September 5		October 7				
	Remain- ing	Disease- free	Remain- ing	Disease- free	Remain- ing	Disease- free			
1	36.0	5.7	6.7	0.0	0.3	0.0	111.8	14.5	
2	98.9	96.0	96.8	95.3	75.9	81.3	109.3	14.8	
3	98.7	97.5	92.8	99.5	69.1	97.7	117.5	14.6	
4	99.1	99.5	95.9	99.6	82.4	97.1	111.8	13.9	
5	99.1	99.5	96.8	97.3	88.2	72.3	121.8	13.8	
6	99.1	96.0	97.4	93.5	80.2	63.1	114.8	15.0	
7	97.6	97.3	81.2	75.5	46.7	24.4	116.0	14.2	
8	98.1	98.9	88.2	71.1	52.7	41.7	100.8	14.3	
9	98.4	97.4	93.2	64.6	56.2	19.8	93.7	14.6	
10	96.3	99.8	93.1	97.2	73.2	63.5	112.8	15.3	
11	96.2	72.8	76.4	35.7	28.1	1.0	115.2	15.6	
12	98.0	93.5	81.8	69.1	54.8	47.9	129.3	14.5	
13	98.4	98.1	94.1	99.1	75.1	94.3	126.2	15.7	
L. S. D.	19.1	2.6	7.8	10.9	19.9	16.8	27.4	19.9	1.2
	99.1	3.5	10.4	13.7	26.4	22.3	36.4	26.5	1.6

Table 12.—1946 spray schedules. Materials and rates of usage in Pennsylvania.

Plot	Petal-fall	Shuck	First cover	Second cover	Pre-harvest	Post-harvest
0	No spray	No spray	No spray	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Bordeaux 2-6 100
1	Lime-sulfur, 2 gal.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Lime-sulfur, 2 gal.	Lime-sulfur, 2 gal.; lead, 2; lime, 3.	Bordeaux 1½-4 100;	Bordeaux 2-6 100
2	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Bordeaux 1½-4 100;	Bordeaux 2-6 100
3	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Isotlan Q15, 1 qt.; lead, 2; lime, 3; Orthex, 1 pt.	Bordeaux 2-6 100
4	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Zerlate, 1½; lead, 2.	Bordeaux 2-6 100
5	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Tenn. 26, 2; lead, 2; lime, 3.	Bordeaux 2-6 100
6	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.	Isotlan Q15, 1 qt.; lead, 2; lime, 3; Orthex, 1 pt.	Isotlan Q15, 1 qt.; lead, 2; lime, 3; Orthex, 1 pt.	Bordeaux 2-6 100
7	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.	Zerlate, 1½; lead, 2.	Zerlate, 1½; lead, 2.	Bordeaux 2-6-100
8	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.
9	Comp. 341, 2 qts.; Isothan Q15, 1 pt.	Comp. 341, 2 qts.; Isothan Q15, 1 pt.; lead, 2; lime, 3.	Comp. 341, 2 qts.; Isothan Q15, 1 pt.	Comp. 341, 2 qts.; Isothan Q15, 1 pt.; lead, 2; lime, 3.	Comp. 341, 2 qts.; Isothan Q15, 1 pt.; lead, 2; lime, 3.	Comp. 341, 2 qts.; Isothan Q15, 1 pt.
10	Isotlan Q15, 1 qt.; Orthex, 1 pt.	Isotlan Q15, 1 qt.; lead, 2; lime, 3; Orthex, 1 pt.	Isotlan Q15, 1 qt.; Orthex, 1 pt.	Isotlan Q15, 1 qt.; lead, 2; lime, 3; Orthex, 1 pt.	Isotlan Q15, 1 qt.; lead, 2; lime, 3; Orthex, 1 pt.	Isotlan Q15, 1 qt.; Orthex, 1 pt.
11	Same as Plot 10 except used the old "non-stabilized" type of Isotlan Q15.	Comp. 337, 5 qts.; lead, 2; lime, 3.	Comp. 337, 5 qts.	Comp. 337, 5 qts.; lead, 2; lime, 3.	Comp. 337, 5 qts.; lead, 2; lime, 3.	Comp. 337, 5 qts.
12	Copper quinolinolate, 1; lime, 3; Orthex, 1 pt.	Copper quinolinolate, 1½; lead, 2; lime, 3; Orthex, 1 pt.	Copper quinolinolate, 1½; lime, 3; Orthex, 1 pt.	Copper quinolinolate, 1½; lead, 2; lime, 3; Orthex, 1 pt.	Copper quinolinolate, 1½; lead, 2; lime, 3; Orthex, 1 pt.	Copper quinolinolate, 1½; lime, 3; Orthex, 1 pt.
13	Zerlate, 1½; Gamtox, 3.	Zerlate, 1½; lead, 2.	Zerlate, 1½	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.
14	Zerlate, 1½	Zerlate, 1½; lead, 2.	Zerlate, 1½	Zerlate, 1½; lead, 2.	Zerlate, 1½; lead, 2.	Zerlate, 1½
15	Zerlate, 1½	Zerlate, 1½; lead, 2.	Zerlate, 1½	Zerlate, 1½; lead, 2.	Zerlate, 1½; lead, 2.	Zerlate, 1½
16	Comp. 341, 1 gal.; Gamtox, 3.	Comp. 341, 1 gal.; Gamtox, 3.	Comp. 341, 1 gal.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.; lead, 2; lime, 3.	Comp. 341, 1 gal.
17	Fernate, 1½	Fernate, 1½; lead, 2.	Fernate, 1½	Tenn. 26, 2; lead, 2; lime, 3.	Tenn. 26, 2; lead, 2; lime, 3.	Tenn. 26, 2; lime, 3.
18	Tenn. 26, 2; lime, 3.	Tenn. 26, 2; lead, 2; lime, 3.	Tenn. 26, 2; lime, 3.	Tenn. 26, 2; lead, 2; lime, 3.	Tenn. 26, 2; lead, 2; lime, 3.	Tenn. 26, 2; lime, 3.
19	Same as Schedule 19 except used Warner's "PHD" or "Pressure Hydrated Lime".					
20						

¹ This special preparation of Isotlan Q15 was used only in this schedule.

² Octyl alcohol added in each spray as an anti-foaming agent in amounts varying up to 200 ml.

Table 13.—Summary of Pennsylvania data for 1946. See table 12 for complete schedule of treatments.

Percentage leaves remaining and percentage remaining leaves disease-free of 300 originally tagged per tree.									
Plot	June 8-10		August 8-9		September 13		Mean number fruits per pound	Percent- age of soluble solids in fruits	Percent- age of malic acid in fruits
	Remain- ing	Disease- free	Remain- ing	Disease- free	Remain- ing	Disease- free			
0	87.1	10.4	21.5	2.2	17.9	1.3	109.4	13.7	1.1483
1	98.7	49.4	77.6	26.4	69.5	11.7	127.3	17.6	1.4403
2	99.5	79.6	88.8	59.5	87.6	59.7	116.0	16.7	1.2651
3	98.9	75.0	87.2	48.9	83.3	40.9	110.6	15.6	1.2586
4	99.4	74.0	92.8	58.7	91.9	64.3	116.4	15.7	1.1418
5	99.2	77.1	88.6	54.8	86.5	49.9	108.1	15.8	1.1938
6	99.0	73.8	91.0	44.4	86.2	33.3	117.1	15.9	1.2002
7	98.9	81.2	83.2	62.0	81.0	62.8	114.6	15.7	1.1613
8	99.1	79.3	86.8	51.9	73.5	15.8	113.7	16.3	1.1548
9	98.9	89.7	84.9	57.3	75.0	21.6	114.4	15.9	1.1613
10	99.4	89.1	91.3	59.3	69.7	8.7	126.3	17.1	1.1029
11	99.1	85.1	86.4	57.1	76.2	19.1	120.3	16.3	1.1873
12	98.9	80.5	80.8	41.5	61.4	9.4	113.7	15.2	1.1418
13	98.3	56.8	88.3	35.9	87.6	29.8	112.3	16.5	1.2846
14	99.0	64.2					101.3	16.0	
15	98.6	69.5	86.0	49.0	81.6	51.3	121.0	16.4	1.1159
16	99.2	54.2	91.3	38.6	83.5	30.4	123.7	17.8	1.2067
17	99.0	78.4	86.6	48.8	66.3	11.6	111.1	15.8	1.2002
18	98.0	32.7					115.4	16.2	
19	99.1	51.3	88.7	29.7	83.6	26.8	132.0	18.1	1.3949
20	99.2	58.3	89.9	34.9	86.0	28.7	130.0	19.0	1.2132
L.D. 19:1	2.6	10.6	6.1	12.2	10.1	12.8	9.3	0.8	(1)
99:1	13.5	14.0	8.0	16.1	18.3	16.9	12.3	1.1	

¹ Titratable acidity calculated as malic acid. Composite samples titrated in duplicate.

Table 14.—Summary of data from 1946 grower sprayed plots.

Or- chard	Date of counts	Compound 341			Lime sulfur		
		Percentage of leaves remaining	Percentage of remaining leaves disease-free	Number cherries per pound	Percentage of leaves remaining	Percentage of remaining leaves disease-free	Number cherries per pound
1.	May....31	100	99.1	-----	100	93.5	-----
	June....17	100	96.1	-----	100	77.8	-----
	July....10	-----	-----	111.2	-----	-----	138.1
	Aug....7	94.2	85.2	-----	81.3	35.8	-----
2.	May....31	100	99.6	-----	100	99.6	-----
	June....17	100	97.6	-----	100	96.9	-----
	July....5	-----	-----	126.8	-----	-----	130.9
3.	June....21	100	99.2	-----	100	97.8	-----
	Aug....15	87.5	92.0	-----	91.5	86.7	-----
	July....5	-----	-----	99.4	-----	-----	102.6
4.	June....17	100	98.9	-----	100	98.0	-----
	Aug....15	85.6	83.4	-----	83.7	75.6	-----
5.	June....21	100	94.4	-----	100	92.0	-----
	Aug....19	92.6	81.1	-----	78.9	49.3	-----
6.	July....10	100 ¹	92.8	107.7	100 ¹	61.6	118.3
	Aug....19	93.1	91.2	-----	93.2	34.6	-----

¹ Heavy defoliation had occurred on the lime-sulfur plot prior to these counts. The figure given is concerned with the 300 leaves per tree actually tagged on July 10.

These tests were set up in grower-sprayed orchards, using from about $\frac{1}{2}$ to 6 acres for Compound 341 and the balance of the orchard for lime-sulfur. Compound 341 at 1 gallon and lime sulfur at 2 gallons were used in the first 3 or 4 sprays, depending on the orchard, and followed by 2 sprays of Bordeaux mixture or one of the proprietary copper compounds. Bordeaux mixture was used at 1 $\frac{1}{2}$ -3-100 and 2-6-100, and the proprietary copper compounds at $\frac{1}{2}$ to $\frac{3}{4}$ pound actual copper. Leaf records were taken on 300 leaves per tree, using 6 trees per treatment with 6 tagged branches per tree selected at a height of 4 to 6 feet. Records on fruit size were taken by picking, weighing, and counting 1 pound samples from each of 10 trees per treatment.

These tests were duplicated in several other orchards, but no extensive counts were made.

Table 15.—1947 spray schedules. Materials and rates of usage in Virginia.

Plot	Petal-fall	Shuck	First cover	Second cover	Post-harvest
0	Check, no spray.	No spray.	No spray.	No spray.	No spray.
1	341-A 2½ lb., Gamtox 2 lb.	341-A 2½ lb., Gamtox 2 lb.	341-A 2½ lb., Gamtox 2 lb.	Zerlate 2 lb.	Bordeaux 1½ 3-100
2	341-B 3 lb., Gamtox 2 lb.	341-B 3 lb., Gamtox 2 lb.	341-B 3 lb., Gamtox 2 lb.	Zerlate 2 lb.	Bordeaux 1½ 3-100
3	341-C 1 qt., Gamtox 2 lb., lime 4 oz.	341-C 1 qt., Gamtox 2 lb., lime 4 oz.	341-C 1 qt., Gamtox 2 lb., lime 4 oz.	Zerlate 2 lb.	Bordeaux 1½ 3-100
4	Lime-sulfur 2 gal., lime 3, lead 2.	Lime-sulfur 2 gal., lime 3, lead 2.	Lime-sulfur 2 gal., lime 3, lead 2.	Bordeaux 1½ 3-100	Bordeaux 1½ 3-100
5	Bordeaux 1½ 3-100, lead 2.	Bordeaux 1½ 3-100, lead 2.	Bordeaux 1½ 3-100, lead 2.	Bordeaux 1½ 3-100	Bordeaux 1½ 3-100
6	Tenn. 26 2 lb., lime 3, lead 2.	Tenn. 26 2 lb., lime 3, lead 2.	Tenn. 26 2 lb., lime 3, lead 2.	Tenn. 26, 2 lb., lime 3.	Tenn. 26 2 lb., lime 3.
7	COCs 1½ lb., lime 3, lead 2.	COCs 1½ lb., lime 3, lead 2.	COCs 1½ lb., lime 3, lead 2.	COCs 1½ lb., lime 3.	COCs 1½ lb., lime 3.
8	Fernate 2 lb., Gamtox 2 lb.	Fernate 2 lb., Gamtox 2 lb.	Fernate 2 lb., Gamtox 2 lb.	Fernate 2 lb.	Fernate 2 lb.
9	Zerlate 2 lb., Gamtox 2 lb.	Zerlate 2 lb., Gamtox 2 lb.	Zerlate 2 lb., Gamtox 2 lb.	Zerlate 2 lb.	Zerlate 2 lb.
10	Phygon 1 lb., Gamtox 2 lb.	Phygon 1 lb., Gamtox 2 lb.	Phygon 1 lb., Gamtox 2 lb.	Phygon 1 lb.	Phygon 1 lb.
11	Zinc-8, 1 lb., Gamtox 2 lb.	Zinc-8, 1 lb., Gamtox 2 lb.	Zinc-8, 1 lb., Gamtox 2 lb.	Zinc-8, 1 lb.	Zinc-8, 1 lb.

Table 16.—Summary of Virginia fruit data for 1947. See table 15 for complete schedule of treatments.

Plot number	Mean number fruits per pound	Percentage of soluble acids	Percentage of malic acid in fruits	Percentage of spray injured fruits
0-----	113.50	14.08	1.011	0.0
1-----	114.83	13.27	.926	39.17
2-----	123.16	13.23	.899	34.83
3-----	124.33	14.39	1.022	66.33
4-----	119.00	14.78	1.088	3.67
5-----	119.00	15.61	1.011	0.17
6-----	108.16	13.68	.988	0.0
7-----	120.00	14.39	.968	0.0
8-----	122.00	13.18	.956	0.0
9-----	114.00	14.06	1.009	0.0
10-----	110.66	13.46	.929	0.0
11-----	100.16	13.49	.956	0.0
L. S. D. 19:1--	13.2	.92	.23	10.32
99:1--	17.6	1.22	.31	13.74

Table 17.—Spray schedules. Materials and rates of usage in Pennsylvania. 1947.

Plot	Petal-fall	Shuck	First cover
0	No spray	No spray	No spray
1	Comp. 341-A 2½	Comp. 341-A 2½	Tenn. 26 3, lime 3
2	Comp. 341-A 2½, lead 2, lime 3	Comp. 341-A 2½, lead 2, lime 3	Tenn. 26 3, lime 3
3	Comp. 341-A 2½, Gamtox 2	Comp. 341-A 2½, Gamtox 2	Tenn. 26 3, lime 3
4	Comp. 341-B 3	Comp. 341-B 3	Tenn. 26 3, lime 3
5	Comp. 341-B 3, lead 2, lime 3	Comp. 341-B 3, lead 2, lime 3	Tenn. 26 3, lime 3
6	Comp. 341-B 3, Gamtox 2	Comp. 341-B 3, Gamtox 2	Tenn. 26 3, lime 3
7	Comp. 341-C 1 qt., lime 4 oz.	Comp. 341-C 1 qt., lime 4 oz.	Tenn. 26 3, lime 3
8	Comp. 341-C 1 qt., lead 2, lime 3	Comp. 341-C 1 qt., lead 2, lime 3	Tenn. 26 3, lime 3
9	Comp. 341-C 1 qt., lime 4 oz., Gamtox 2	Comp. 341-C 1 qt., lime 4 oz., Gamtox 2	Tenn. 26 3, lime 3
10	Comp. 341-HCl 2.7 ,lead 2, lime 3	Comp. 341-HCl 2.7, lead 2, lime 3	Comp. 341-HCl 2.7, lime 3
11	Comp. 341-A 1133 gm., lead 2, lime 3	Comp. 341-A 1133 gm., lead 2, lime 3	Comp. 341-A 1133 gm., lime 3
12	Comp. 341-A 850 gm., lead 2, lime 3	Comp. 341-A 850 gm., lead 2, lime 3	Comp. 341-A 850 gm., lime 3
13	Comp. 341-A 567 gm., lead 2, lime 3	Comp. 341-A 567 gm., lead 2, lime 3	Comp. 341-A 567 gm., lime 3
14	Comp. 341-B 1361 gm., lead 2, lime 3	Comp. 341-B 1361 gm., lead 2, lime 3	Comp. 341-B 1361 gm., lime 3
15	Comp. 341-B 1020 gm., lead 2, lime 3	Comp. 341-B 1020 gm., lead 2, lime 3	Comp. 341-B 1020 gm., lime 3
16	Comp. 341-B 680 gm., lead 2, lime 3	Comp. 341-B 680 gm., lead 2, lime 3	Comp. 341-B 680 gm., lime 3
17	Comp. 341-A 850 gm., lead 2, lime 3, Orthex 1 pt.	Comp. 341-A 850 gm., lead 2, lime 3, Orthex 1 pt.	Comp. 341-A 850 gm., lime 3 Orthex 1 pt.
18	Tenn. 26 2, lead 2, lime 3	Tenn. 26 2, lead 2, lime 3	Tenn. 26 2, lime 3
19	Lime-sulfur 2 gal., lead 2, lime 3	Lime-sulfur 2 gal., lead 2, lime 3	Lime-sulfur 2 gal., lime 3

Table 18.—Cherry leaf spot in Sunset orchard. 1947.¹

Plot	Material	Percentage of leafspot
0	Check.....	100.0
1	341 A.....	59.9
2	341 A, lead, lime.....	57.2
3	341 A, Gamtox.....	66.3
4	341 B.....	48.1
5	341 B, lead, lime.....	56.8
6	341 B, Gamtox.....	58.8
7	341 C, lime 4 oz.....	35.4
8	341 C, lead, lime 3 lb.....	40.1
9	341 C, lime 4 oz., Gamtox.....	29.7
10	341 HCl, lead, lime.....	24.3
11	341 A, lead, lime (1 lb. actual).....	62.1
12	341 A, lead, lime ($\frac{3}{4}$ lb. actual).....	62.2
13	341 A, lead, lime ($\frac{1}{2}$ lb. actual).....	78.3
14	341 B, lead, lime (1 lb. actual).....	54.1
15	341 B, lead, lime ($\frac{3}{4}$ lb. actual).....	61.1
16	341 B, lead, lime ($\frac{1}{2}$ lb. actual).....	61.1
17	341 A ($\frac{3}{4}$ lb. actual), lead, lime, Orthex.....	75.6
18	Tenn. 26, lead, lime.....	37.8
19	L. S. 2, lead, lime.....	52.1
	Least significant diff. for odds 19:1.....	10.7
	99:1.....	14.1

¹ Counts June 5-10 on Plots 1-9.

Counts June 12-16 on Plots 10-19.

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